

REMARKS

Upon entry of the present amendment, Claims 1-4, 7, 9, 12-39 and 41-48 are in the application, of which claims 1, 2, 14, 32 and 34 are independent, and of which claims 12-17, 19, 21-39, 41, 42 and 44 stand withdrawn from consideration as non-elected inventions. New claims 45-48 are directed to the elected invention.

After careful consideration of the objections and rejections set forth in the Office Action, applicant respectfully submits that as amended, claims 1-4, 7, 9, 18, 20, 43 and 45 patentably distinguish over the art of record, and requests allowance of all pending claims, as discussed further below.

Amendments Presented

Applicant has herein revised claims 1-4, 7, 9, 18, 20 and 43, cancelled claims 5, 6, 8, 10 and 11, and added claims 45-46 to the application. Particularly: claim 1 now more specifically defines a production method for a carbide sintered compact including the steps previously defined, as well as the step of sintering the produced compact, wherein the high polymer organic substance exhibits a function as a sintering aid of the carbide powder, and wherein the porosity of the sintered compact is 10 volume % or less; claim 2 is rewritten as an independent claim similar to amended claim 1, but more specifically directed to a production method for a boron carbide sintered compact and also defines that the high polymer organic substance functions as a sintering aid to control the grain growth of boron carbide, and a part of the sintering aid is taken into boron carbide crystals; claims 3, 4, 7, 9, 18, 20 are now made dependent from amended claim 2; new claim 45 depends from claim 7 and further defines that the sintering step is

performed under atmospheric pressure and a non-oxidizing atmosphere; claim 43 is now dependent from claim 45; new claim 46 further defines that the production method of claim 1 is a wet method and that the mixture is a slurry; and new claims 47-48 further define the high polymer organic substance.

Applicant respectfully submits that all of the above amendments are fully supported by the original disclosure, including the discussion at page 12, lines 12-17 and page 17, line 10 - page 18, line 24 of the specification. Applicant further respectfully submits that the above amendments do not add any impermissible new matter to the application.

Further, applicant respectfully submits that the above amendments to claims 1-4 deleting the language "wet-type" overcomes the rejection of claims 1-3 are rejected under 35 USC 112, second paragraph, as set forth at item 7 of the Office Action, and it is respectfully requested that such rejection be reconsidered and withdrawn.

Still further, regarding the Examiner's objections to claims 4-11 as being in improper form and to claim 20 as having an informality as set forth at items 5 and 6 of the Office Action, applicant respectfully submits that the sources of these objections were cured in the Preliminary Amendment-A filed concurrently with the application, and it is respectfully requested that such objections be reconsidered and withdrawn. Applicant gratefully acknowledges the Examiner's telephonic interview with applicant's representative on or about November 29, 2004 regarding such objections. During such interview, it was agreed that the response to the Office would refer to the changes presented in Preliminary Amendment-A for overcoming the objections.

Restriction Requirement

At items 1-4 of the Office Action, the Examiner acknowledges the applicant's election of

the invention of Group I in response to the restriction requirement, asserts that claims 12, 13, 19, and 20 (21?) were improperly listed in the original restriction requirement as method claims, and thus has regrouped these claims with non-elected Group III; withdraws claims 12-17, 19, 21-42, and 44 from consideration as being drawn to a non-elected invention; and makes the restriction final..

After careful consideration of the objections and rejections set forth in the Office Action, applicant respectfully submits that as amended, claims 1-4, 7, 9, 18, 20, 43 and 45 patentably distinguish over the art of record, and requests allowance of all pending claims, as discussed further below.

Claim rejections – 35 USC 102

Claim 1 has been rejected under 35 USC 102(b) as anticipated by Nover (5, 530,081).

In his rejection, the Examiner referred to col. 3, lines 46-64 of the reference.

Applicant's Response

Upon careful consideration and in light of the above amendment to claim 1, applicant respectfully submits that the rejection is overcome and that claim 1 is clearly patentably distinct over the Nover reference, based on the following.

Initially, claim 1 now defines a production method for a carbide sintered compact in which carbide powder is coated with a high polymer organic substance that is substantially insoluble in the solvent. This is very beneficial and advantageous since the coated powder is dispersed uniformly, and thereby can most efficiently function as a *compacting aid and sintering aid*. Nover's silicon carbide material does not include carbide powder coated with a high polymer organic substance.

Additionally, applicant respectfully submits that Nover's compacting method is not a wet

method involving use of a slurry (claim 46), but is a *plastic shaping method* such as injection molding (which is expressly *excluded* from the scope of the present invention, as discussed at the first full paragraph on page 15 of the specification). More particularly, Nover does not disclose a polymer coated with a high polymer organic substance and mixed with a solvent as required by claim 1, but instead discloses (at his col. 3, lines 46-50) that either his polycarbosilane is initially swelled in an organic solvent and then mixed with the silicon carbide powder, or the "mixture constituents are simultaneously brought into contact with each other."

Further, applicant notes that Nover creates his "swellable" polycarbosilanes via crosslinking induced through heat treatment (see his col. 3, lines 29-33), whereas such crosslinked polycarbosilanes are contrary to forming the mixture of coated carbide powder particles and a solvent as done according to the present invention.

In this regard, applicant respectfully disagrees with the Examiner's position at item 2 of the Office Action that the claim language "substantially insoluble" encompasses the "swellable" polycarbosilanes used by Nover, because such position does not consider the complete requirements of claim 1 relating to the high polymer organic substance, but only the "substantially insoluble" requirement. Particularly, Nover creates his "swellable" polycarbosilanes via "crosslinking induced through heat treatment" (see his col. 3, lines 29-33). Apart from the fact that Nover does not coat his carbide powder with any high polymer organic substance prior to mixing with a solvent as discussed above, Nover's crosslinked polycarbosilanes are inconsistent with the concept of coating carbide powder particles as required by to the present invention.

Based on the foregoing, the rejection of claim 1 based on the Nover reference is believed

to be overcome, and it is respectfully requested that the rejection be reconsidered and withdrawn.

Claims 1 and 3 are rejected under 35 USC 102 (b) as being anticipated by Ohnsorg (4,233,256). In his rejection, the Examiner referred to Example 1 of the reference.

Applicant's Response

Upon careful consideration and in light of the above amendments to claims 1 and 3, applicant respectfully submits that this rejection is also overcome and that claims 1 and 3 are clearly patentably distinct over the Ohnsorg reference, based on the following.

Applicant respectfully submits that Ohnsorg's method, like that of Nover, does not involve use of carbide powder coated with a high polymer organic substance that is substantially insoluble in a solvent with which it is mixed, nor is Ohnsorg's method a wet method in which coated carbide (boron carbide) powder is mixed with solvent to form a slurry that subsequently molded – produced into a compact, noting that claim 3 now depends from claim 2. Instead, Ohnsorg discloses an injection molding method (a plastic shaping method), which is expressly excluded by the present invention.

Based on the foregoing, the rejection of claims 1 and 3 based on the Ohnsorg reference is believed to be overcome, and it is respectfully requested that the rejection be reconsidered and withdrawn.

Claims 1 and 2 are rejected under 35 USC 102 (b) as being anticipated by Prochazka (4,004,934). The Examiner states that Prochazka teaches dispersing coated carbide powder (col. 5, lines 2-3) in water (col. 5, line 48) and compacting the body (i.e., slip-casting, col. 5, line 47).

Applicant's Response

Upon careful consideration and in light of the above amendments to claims 1 and 2, applicant respectfully submits that this rejection is also overcome and that claims 1 and 2 are clearly patentably distinct over the Prochazka reference, based on the following.

Initially, applicant submits that Prochazka does not disclose the method steps of either claim 1 or claim 2 in which carbide powder coated with a high polymer organic substance is formed into a mixture with a solvent in which the organic substance is substantially insoluble, and then the mixture is produced into a compact which is subsequently sintered such that the organic substance functions as a sintering aid. Rather, in Prochazka's method a carbonaceous organic compound is coated onto the surface of the silicon carbide powder, which is then pyrolyzed. The powder which has undergone pyrolysis is then compacted by slip casting, as discussed at his col. 5, lines 47-48, for example. Prochazka's overall discussion of the introduction of carbon onto silicon carbide powder via a solution of carbonaceous organic compound, presented at his col. 4, line 6 – col. 5, line 16, clearly indicates that the coated organic compound is "subsequently pyrolyzed into carbon" to provide a uniform dispersion of the carbon on the silicon carbide powder at a submicron level. It is such carbon coated powder, rather than the carbide powder coated with the organic substance, which is then used in the various molding techniques (including slip casting) as discussed at Prochazka's column 5. Further, unlike the present invention, Prochazka does not require (or suggest) that the organic substance be insoluble within the solvent in a subsequently formed slurry.

Applicant respectfully submits that the above distinctions are very significant. Since the carbon obtained by pyrolysis is cooled once in Prochazka, the function of the carbon as a

sintering aid is inferior to the case of the present invention where it is directly used as a sintering aid. Prochazka also has a drawback that the silicon ceramic carbide powder is aggregated in the course of the pyrolysis, and the powders cannot be successfully dispersed in the compacting step.

As regards claim 2, this claim has been amended herein to be in independent form and to recite method steps for producing a boron carbide sintered compact. Again, these amendments to are supported in the specification, especially on page 17, line 11 and on page 18, lines 14-22. The applicant respectfully submits that the limitations recited in this claim are not disclosed by Prochazka or any of the cited references. For example, Prochazka does not disclose coating a boron carbide powder with high polymer organic substance that is substantially insoluble in water. Further, Prochazka's method is specifically directed to production of a "sintered dense silicon carbide", rather than to a "boron carbide sintered compact" as now defined in claim 2, whereas it is conventionally understood as fact that boron carbide is more difficult to compact than other carbides, while a (commercially practical) slip casting technique for boron carbide was not known prior to the present invention, as discussed at the paragraph on page 3, lines 11-16 of the present specification. Still further, Prochazka does not disclose a sintered boron carbide compact having a porosity of 10 volume % or less as claimed.

Based on the foregoing, the rejection of claims 1 and 2 based on the Prochazka reference is believed to be overcome, and it is respectfully requested that the rejection be reconsidered and withdrawn.

Claims 18, 20, and 43 are rejected under 35 USC 102(b) as being anticipated by Arai et al (5,145,812). The Examiner states that Arai discloses a mixture of powder, solvent, and polymer precursor (col. 7-8) which acts as a binding/sintering aid, and discloses that the

mixture may be slip cast and sintered under the claimed conditions (col. 10). The Examiner further states that Arai discloses that any carbide powder may be used (col. 10, line 58), and that the claimed particle sizes are encompassed by Examples 11 and 12.

Applicant's Response

Upon careful consideration and in light of the above amendments to claims 2, 18, 20 and 43, applicant respectfully submits that this rejection is also overcome and that the rejected claims are clearly patentably distinct over the Arai reference, based on the following.

Initially, applicant respectfully submits that Arai does not disclose powder coated with a high polymer organic substance which is substantially insoluble in a solvent mixed with the coated powder to form a slurry, and which functions as a sintering aid when the slurry is subsequently produced into a compact and sintered as required by independent claim 2. Rather, according to Arai's disclosure, a silicon nitride based ceramic is formed using polysilazane and a ceramic powder or ceramic fiber. Such polysilazane is not a high polymer organic substance as defined in the present application (see, for example, page 12, lines 12-17 of the original specification). Further, to any extent that Arai forms a compact from his a slurry of the polysilazane and ceramic powder, he does not use a solvent in which the polysilazane is substantially insoluble, as understood from Arai's disclosure at his col. 8, lines 34-40 and col. 10, lines 33-56. The examples 11 and 12 of Arai involve press molding.

As regards claim 18, the applicant further respectfully disagrees with this rejection since Arai never discloses a given material in his compact production method that functions as both a compacting aid and a sintering aid.

As regards claims 20 and 43, the applicant further respectfully disagrees with this

rejection because Arai does not specifically disclose a boron carbide sintered compact production method involving a particular particle size, a compacting aid and a sintering aid as defined in claim 20, or the additional HIP treatment and a sintering step performed under atmospheric pressure and a non-oxidizing atmosphere required by claim 43 (noting that claim 43 depends from new claim 45).

Regarding claim 20, applicant respectfully submits that the 200 mesh size used in Arai's Examples 11, 12 corresponds to a particle size of 74 microns, not 0.1 – 1.4 microns as required by claim 20. Also, while Arai suggest that "any ceramic powder including ...metal carbides" may be used in his method, this statement is very general and (again) does not accurately reflect the known fact that boron carbide is more difficult to compact than other carbide, and that a slip casting technique for same was not known prior to the present invention, as discussed at the paragraph on page 3, lines 11-16 of the present specification.

With regard to claim 43, while Arai mentions "an HIP method" at his col. 10, lines 6-16, this is mentioned as a method for sintering, the compact molding, not as treatment subsequent to sintering.

New Claims

New claims 45-48 are believed to be allowable based on the merits of claims 1-2, as well as on the merits of the features presented in these claims.

Conclusion

Based on all of the foregoing, applicant respectfully submits that all of the objections and rejections set forth in the Office Action are overcome, and that as presently amended, all of the pending claims are believed to be allowable over all of the references of record, whether considered

singly or in combination.

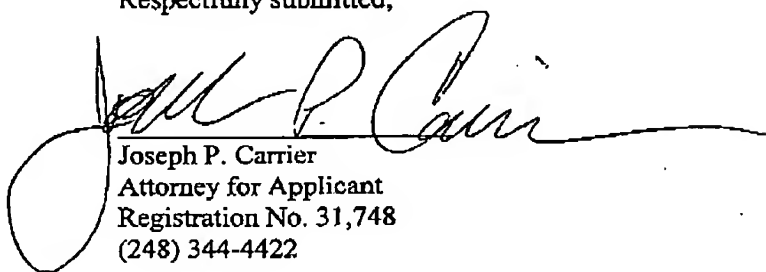
Applicant requests reconsideration and withdrawal of the rejection of record, and allowance of the pending claims.

If the Examiner is not fully convinced of all of the claims now in the application, applicant respectfully requests that the Examiner telephonically contact applicant's undersigned representative to expeditiously resolve prosecution of the application.

Favorable consideration is respectfully requested.

Respectfully submitted,

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